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TITLE: Downhole rotary fluid- pressure motor

PUBN-DATE: August 7, 1985

INVENTOR-INFORMATION:

NAME	COUNTRY
ZAKHAROV, JURY VASILIEVIw?w?	N/A
NIKOMAROV, SAMUIL SOLOMOw?w?CH	N/A
KOCHNEV, ANATOLY MIKHAILw?w?H	N/A
GUSMAN, MOISEI TIMOFEEVIw?w?	N/A
BALDENKO, DMITRY FEDOROVw?w?	N/A

ASSIGNEE-INFORMATION:

NAME	COUNTRY
INST BUROVOI TEKHNIK	N/A
PERM VNII BUROVOJ TEKHN	N/A

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INT-CL (IPC): F03C002/08

EUR-CL (EPC): E21B004/02 ; F04C002/107, F04C015/00 , F16D001/09 , F16D001/097

US-CL-CURRENT: 418/48

ABSTRACT:

CHG DATE=19990617 STATUS=O> In an eccentric-screw type motor for driving eg. a rock- breaking tool, the rotor 2 is connected to an output shaft 7 by way of a torsion bar 6, the latter being attached to the rotor in an area above the zone of contact between the rotor and stator teeth in order to stabilize the motion of the rotor. The shaft may be hollow and the lower end of the torsion bar may be connected thereto by means of a coupling 9 with holes 9a through which the spent working fluid can enter the shaft and thence flow down to the tool. <IMAGE>

DERWENT-ACC-NO: 1985-192264

DERWENT-WEEK: 198532

TITLE: Oil or gas prospecting rock breaking tool eccentric screw motor - has rotor connected to output shaft via torsion bar

INVENTOR: BALDENKO, D F; GUSMAN, M T ; KOCHNEV, A M ; NIKOMAROV, S S ; ZAKHAROV, J V

PATENT-ASSIGNEE: DRILLING TECHN RES[DRIL] , PERM DRILLING TECHN[PRDRR]

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FR 2558519A	N/A	1984FR-0001056	January 24, 1984
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INT-CL (IPC): E21B004/02, F03C002/08

ABSTRACTED-PUB-NO: GB 2152588A

BASIC-ABSTRACT:

Helical bore-hole motor comprises a rotor and a stator arranged with a given eccentricity and defining high and low pressure chambers for the passage of a fluid medium. A torsion bar is rigidly connected by one end to the rotor and by the other end to a shaft of a spindle assembly. The location of the connection point of the torsion bar to the rotor occupies an area above the zone of contact of helical teeth of the rotor with helical teeth of the stator.

Pref. for connecting the rotor to the torsion bar, the rotor is provided with a recess tapering upwardly and a through-slot disposed above this recess perpendicularly to its axis and communicable therewith. The torsion bar has a conical portion corresponding in shape and dimensions to the tapered recess and terminating in a rectangular tailpiece received by the slot of the rotor and having cross-sectional dimensions conforming to the dimensions of the slot.

ADVANTAGE - Stabilised rotor movement and redn. in mechanical losses.

ABSTRACTED-PUB-NO: GB 2152588B

EQUIVALENT-ABSTRACTS:

Helical bore-hole motor comprises a rotor and a stator arranged with a given eccentricity and defining high and low pressure chambers for the passage of a fluid medium. A torsion bar is rigidly connected by one end to the rotor and by the other end to a shaft of a spindle assembly. The location of the connection point of the torsion bar to the rotor occupies an area above the zone of contact of helical teeth of the rotor with helical teeth of the stator.

Pref. for connecting the rotor to the torsion bar, the rotor is provided with a recess tapering upwardly and a through-slot disposed above this recess perpendicularly to its axis and communicable therewith. The torsion bar has a conical portion corresponding in shape and dimensions to the tapered recess and terminating in a rectangular tailpiece received by the slot of the rotor and having cross-sectional dimensions conforming to the dimensions of the slot.

ADVANTAGE - Stabilised rotor movement and redn. in mechanical losses.

CHOSEN-DRAWING: Dwg.0/6 Dwg.0/6

TITLE-TERMS: OIL GAS PROSPECTING ROCK BREAK TOOL ECCENTRIC SCREW MOTOR ROTOR CONNECT OUTPUT SHAFT TORSION BAR

DERWENT-CLASS: H01 Q49 Q55

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F03C 2/08

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F1F

(71) Applicants
Vsesojuzny Nauchno-Issledovatelsky Institut Burovoi Tekhniki (USSR).
Leninsky prospekt 6, Moscow, USSR.
Permsky Filial Vsesojuznogo Nauchno-Issledovatelskogo Instituta Burovoi Tekhniki (USSR).
ulitsa Karpinskogo 24, Perm, USSR

(72) Inventors
Jury Vasilievich Zakharov
Samuil Solomonovich Nikomarov
Anatoly Mikhailovich Kochnev
Moisei Timofeevich Gusman
Dmitry Fedorovich Baldenko

(74) Agent and/or Address for Service
Marks & Clerk,
57–60 Lincoln's Inn Fields, London WC2A 3LS

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(54) Downhole rotary fluid-pressure motor

(57) In an eccentric-screw type motor for driving eg. a rock-breaking tool, the rotor 2 is connected to an output shaft 7 by way of a torsion bar 6, the latter being attached to the rotor in an area above the zone of contact between the rotor and stator teeth in order to stabilize the motion of the rotor. The shaft may be hollow and the lower end of the torsion bar may be connected thereto by means of a coupling 9 with holes 9a through which the spent working fluid can enter the shaft and thence flow down to the tool.

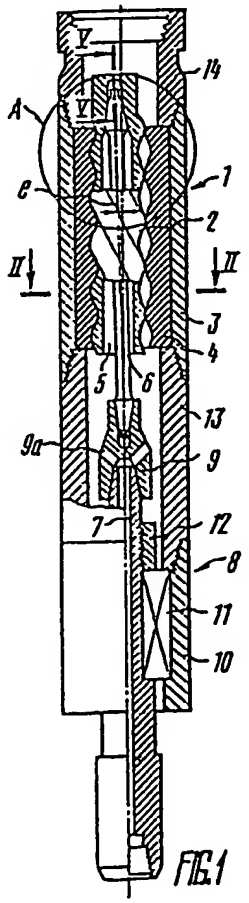

FIG.1

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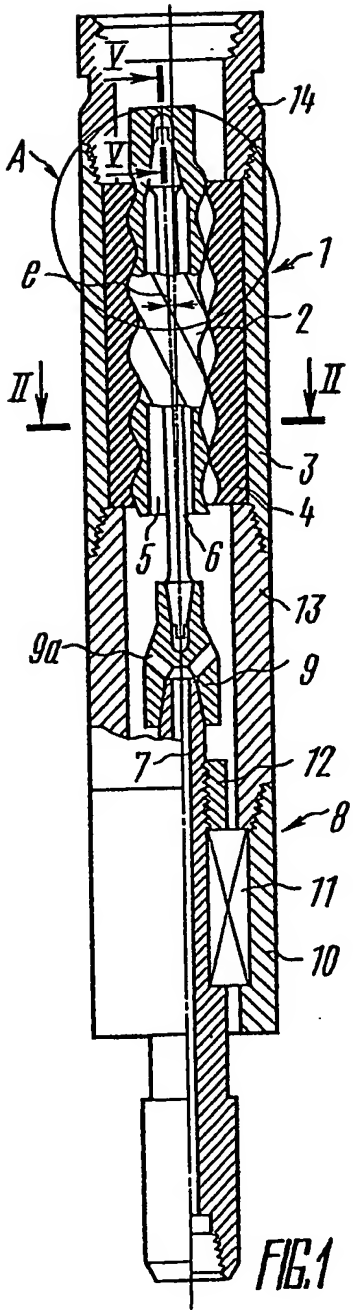

FIG.1

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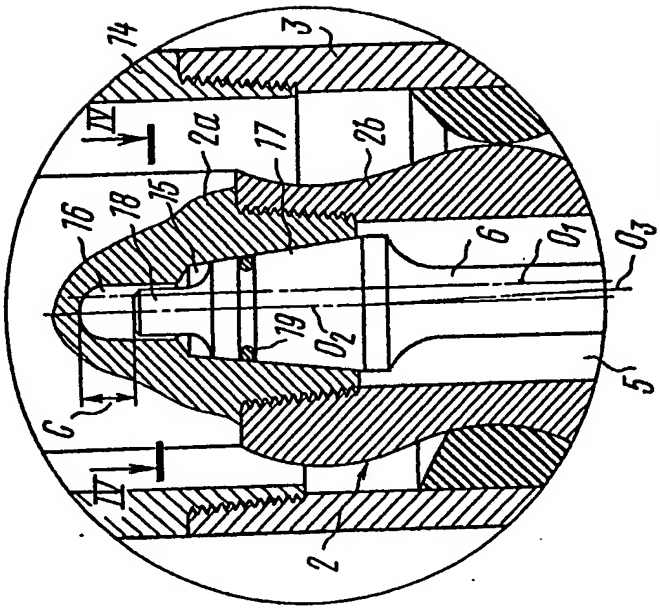

FIG.3

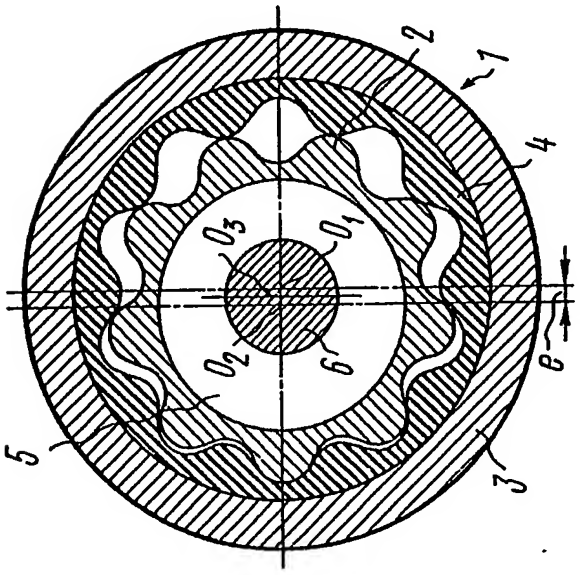

FIG.2

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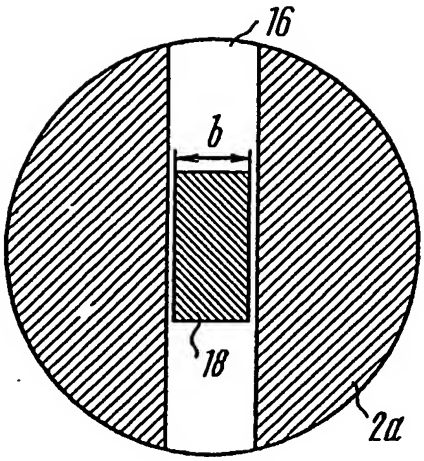

FIG.4

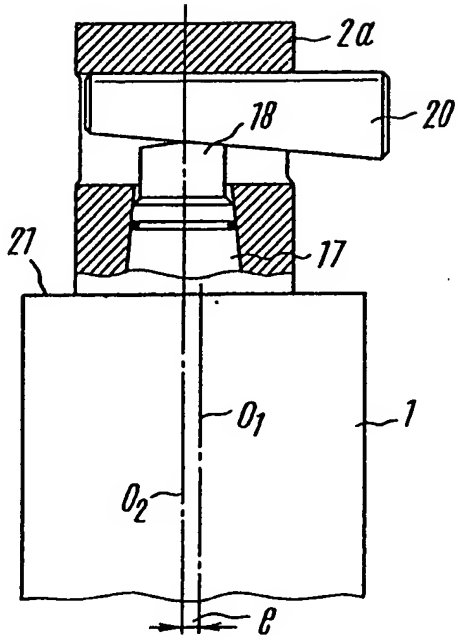

FIG.5

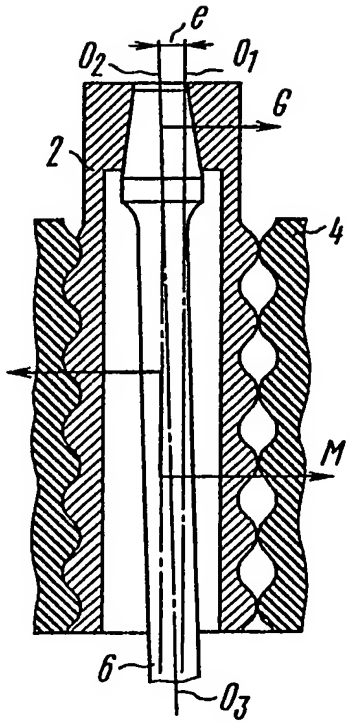

FIG.6

SPECIFICATION

Helical bore-hole motor

This invention relates to well drilling technology, and more particularly to helical bore-hole motors. Such motors can find application for driving rock-cutting tools in bore-hole drilling, especially in drilling for oil and gas. They can be used with equal success for drilling both vertical and inclined bore-holes.

The invention provides a helical bore-hole machine comprising arranged with a preselected eccentricity a rotor and stator assembly defining high and low pressure chambers for the paSsage of a fluid medium therethrough, and a torsion bar rigidly connected by one end thereof to the rotor and by the other end to a shaft of a spindle assembly, according to the invention, connection between the torsion bar and the rotor is disposed above the area of contact of helical teeth of the rotor with helical teeth of the stator.

Preferably, for connecting the rotor to the torsion bar, the rotor is provided with a recess tapering upwardly and a through-slot disposed above this recess perpendicularly to its axis to communicate therewith, whereas the torsion bar has a conical portion corresponding to the tapered recess of the rotor and terminating in a tailpiece of rectangular configuration received by the slot and having in cross-section dimensions corresponding to the dimensions of this slot. Such a connection of the rotor to the torsion bar is structurally simple and reliable in operation.

It is also preferable that an annular groove for accommodating a sealing element be provided in the conical portion of the torsion bar. The provision of such a sealing element would prevent the mating conical surfaces from being damaged by the fluid medium.

Advisably, the height of the through-slot is such that a gap is formed between its end and the end face of the tailpiece of the torsion bar. The provision of such a gap simplifies disassembly of the motor by forcing a wedge tool into the gap to detach the rotor from the torsion bar.

The rotor may be made up of two interconnected sections, particularly one having the tapered recess with the through-slot therein for connection to the torsion bar, and the other section having helical teeth engageable with the helical teeth of the rotor. This arrangement of the rotor requires less effort for its manufacture.

Preferably, the torsion bar is disposed inside the rotor so that the end fae of its tailpiece is above the end face of the stator. This arrangement of the torsion bar makes it possible to detach it from the rotor without disconnecting the stator from the spindle assembly, which is especially important for disassembling the helical bore-hole motor when the rotor and stator are sludged.

In view of the aforegoing, the helical bore-hole motor embodying the present invention ensures stabilized movement of the rotor in the stator, reduces mechanical losses, and therefore increases the load capacity and extends the service life of the motor. In addition, the proposed motor is less complicated to fabricate and operate.

The invention will be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a helical bore-hole motor;

Figure 2 is an enlarged section taken along the line II–II in Fig. 1;

Figure 3 is the detail A in Fig. 1, grossly enlarged;

Figure 4 is a section taken along the line IV–IV in Fig. 3;

Figure 5 is an enlarged section taken along the line V–V in Fig. 1 without an upper adapter but with a wedge tool for detaching the rotor from the torsion bar; and

Figure 6 is a schematic of forces exerted on the rotor in the course of operation of the helical bore-hole motor.

The helical bore-hole motor illustrated comprises a stator 1 and a rotor 2 arranged with a preselected eccentricity e determined by the distance between the respective axes O_1 (Fig. 1) and O_2 of the stator 1 and the rotor 2.

The stator 1 has a metal housing 3 with an elastomeric lining 4 bonded to its inner surface, helical teeth being provided on this elastomeric lining 4. The outer surface of the rotor 2 is likewise provided with helical teeth, the number of teeth on the rotor being one less than the number of teeth on the elastomeric lining 4 of the stator engaging therewith. The helical teeth of the rotor 2 and stator 1 define high and low pressure chambers for the passage under pressure of a fluid medium therethrough to produce a torque.

The interior 5 of the rotor 2 accommodates a torsion bar 6 rigidly connected to the rotor 2 and serving for transmitting torque from the rotor 2 to a hollow shaft 7 (Fig. 1) of a spindle assembly 8. The lower end of the torsion bar 6 is fixedly attached to a coupling 9 secured on the shaft 7 of the spindle assembly 8. The coupling 9 is provided with through-holes 9a for the fluid medium to pass into the interior of the shaft 7.

The torsion bar 6 is so arranged that its lower end is coaxial with the axis O_1 (Fig. 1) of the stator 1, its upper end being coaxial with the axis O_2 of the rotor 2. The axis O_3 of the torsion bar 6 is therefore interposed between the axes O_1 and O_2.

The spindle assembly 8 of the helical bore-hole motor comprises a housing 10 (Fig. 1) with a bearing 11, and the shaft 7 serving to carry a rock breaking tool (not shown). The bearing 11 is affixed to the shaft 7 by means

of a nut 12.

The stator 1 is threadedly connected to the housing 10 of the spindle assembly 8 by way of an adapter 13. The upper end of the stator 1 is likewise threadedly connectable to an adapter 14,which in turn serves for joining the helical bore-hole motor to a string of drill pipes (not shown).

The torsion bar 6 is connected to the rotor 2 in a location substantially above the zone of contact of the helical teeth of the rotor 2 with those of the stator 1. An advantage of this location for connecting the torsion bar 6 to the rotor 2 will be more fully understood when the manner in which the helical bore-hole motor operates is described later in the description. For connecting the rotor 2 to the torsion bar 6 the rotor 2 is provided with a recess 15 (Fig. 3) tapering upwardly. This recess communicates with a through-slot 16 (Figs. 3 and 4) arranged in the rotor above the recess 15 perpendicularly to its axis.

The upper end of the torsion bar 6 has a conical portion 17 in shape and dimensions corresponding to the tapered recess 15 to thereby enter thereinto for connecting the rotor 2 and the torsion bar 6. The portion 17 of the torsion bar 6 terminates in a tailpiece 18 which is received by the slot 16 of the rotor 2.

The tailpiece 18 is rectangular in cross-section with a thickness *b* (Fig. 4) corresponding to the width of the slot 16. This arrangement of the tailpiece 18 makes it impossible for the rotor 2 to turn relative to the torsion bar 6 at the initial moment of operation of the helical bore-hole motor.

In order to prevent the mating conical surfaces of the rotor 2 and the portion 17 of the torsion bar 6 from being damaged by the fluid medium in the course of extended operation of the helical bore-hole motor, a sealing element 19 (Fig. 3) is secured in an annular groove provided in the conical portion 17 of the torsion bar 6. The sealing element 19 is preferably secured at the top part of the conical portion 17 of the torsion bar 6.

The through-slot 16 of the rotor 2 is of such a height that when the tailpiece 18 is received therein a gap *c* remains between the end face of the tailpiece and the end of the slot 16 for a wedge 20 (Fig. 5) to be inserted to detach the rotor 2 from the torsion bar 6.

To increase the contact area of the wedge 20 with the end face of the tailpiece 18, this end face is chamfered an angle equal to the angle of the wedge 20.

For a more simplified manufacture of the rotor 2 (Fig. 3) it is made up of two sections 2a and 2b threadedly interconnected therebetween.

Further, in order to prevent this connection from being loosened, it has a left-hand thread, whereas the tapered recess 15 and the through-slot 16 are provided in the section 2a of the rotor 2. The section 2b of the rotor 2 accommodates the helical teeth engageable with the helical teeth of the stator 1.

The torsion bar 6 is secured so that the end face of its tailpiece 18 is disposed substantially above an end face 21 (Fig. 5) of the stator 1, which enables one to detach the rotor 2 from the torsion bar 6 without extracting the rotor 2 from the stator 1.

The rotor 2 is adapted to execute planetary motion inside the elastomeric lining 4 of the stator 1. The axis O_2 of the rotor 2 is therefore caused to perform translatory rotation relative to the axis O_1 of the stator 1 to move about the circumference of the radius *e* in a counterclockwise direction, whereas the rotor 2 per se rotates about its own axis O_2 clockwise thereby executing absolute rotation.

The helical bore-hole motor described above operates as follows.

A drilling fluid (the fluid medium) forced by a surface pump along the drill string (not shown) is conveyed to the inside of the adapter 14 to enter the high pressure chamber and rotate the rotor 2.

From the bottom part of the stator 1 the drilling fluid is conveyed through the holes 9a of the coupling 9 to the interior of the shaft 7 and escapes through a drill bit (not shown) to the interior of the bore-hole.

It is important that during operation the rotor 2 of the helical bore-hole motor is at all times offset from the axis O_1 of the stator 1 (by the eccentricity *e*) to execute the planetary motion, whereas the shaft 7 of the spindle assembly 8 rotates inside the bearing 11 coaxially with the axis O_1 of the stator 1, which axis coincides with the longitudinal centreline of the motor.

The planetary motion of the rotor 2 is converted into rotation of the shaft 7 thanks to the use of the torsion bar 6. The torsion bar 6 acts to transmit torque and axial force to the shaft 7 through the coupling 9.

The upper end of the torsion bar 6 and the rotor 2 are offset relative to its lower end a distance equal to the eccentricity *e*. With reference to Fig. 6, as a result of such disposition of the torsion bar 6 an elastic force G is exerted by the torsion bar 6 on the rotor 2. In the course of operation the rotor 2 is acted upon by a twisting moment M resulting from unbalanced hydraulic forces, whereby the rotor 2 is caused to be out of alignment in the elastomeric lining 4 of the stator 1.

In the motor under consideration the attachment point of the torsion bar 6 to the rotor 2 overlies the area of contact between the helical teeth of the rotor 2 with the elastomeric lining 4 of the stator 1. Such an arrangement ensures that the motion of the rotor 2 inside the stator 1 is stabilized owing to the fact that the elastic force G of the torsion bar 6 counteracts the twisting moment M arising from the unbalanced hydraulic forces. Stabilized

movement of the rotor 2 reduces specific loads imposed on the rotor in the elastomeric lining 4 of the stator 1 and consequently provides for a longer life of the motor.

The rotor 2 is detached from the torsion bar in the following manner.

During operation of the helical bore-hole motor sludging of the chambers defined by the rotor 2 and stator 1 may occur, in which case the motor must be disassembled; for this purpose the adapter 14 is disconnected from the housing 3 of the stator 1. Thereafter, the wedge 20 is forced into the slot 16 to detach the rotor 2 from the torsion bar 6.

In other respects, the helical bore-hole motor is dismantled in any known suitable manner.

A pilot model of the helical bore-hole motor of 85 mm in diameter has been tested for well drilling. The results of tests have shown that the rotor 2 and stator 1 have become 30 to 35% more durable compared to the rotors and stators of prior art helical bore-hole machines.

CLAIMS

1. A helical bore-hole motor comprising a rotor and a stator arranged with a given eccentricity and defining high and low pressure chambers for the passage of a fluid medium therethrough, and a torsion bar rigidly connected by one end thereof to the rotor and by the other end to a shaft of a spindle assembly, the location of the connection point of the torsion bar to the rotor occupying an area substantially above the zone of contact of helical teeth of the rotor with helical teeth of the stator.

2. A motor as claimed inclaim 1, in which, for connecting the rotor to the torsion bar, the rotor is provided with a recess tapering upwardly and a through-slot disposed above this recess perpendicularly to its axis and communicable therewith, the torsion bar having a conical portion corresponding in shape and dimensions to the tapered recess and terminating in a rectangular tailpiece received by the slot of the rotor and having cross-sectional dimensions conforming to the dimensions of the slot.

3. A motor as claimed in claim 2, in which the conical portion of the torsion bar has an annular groove to accommodate a sealing element.

4. A motor as claimed in claim 2 or 3, in which the height of the slot is such that a gap is available between its end and the end face of the torsion bar tailpiece.

5. A motor as claimed in any of claims 2 to 4, in which the rotor is made up of two interconnected sections, one of the sections having the tapered recess with the through-slot for connection to the torsion bar, the other section having helical teeth engageable with the helical teeth of the stator.

6. A motor as claimed in any of claims 2 to 5, in which the torsion bar is accommodated inside the rotor such that the end face of its tailpiece overlies the end face of the stator.

7. A helical bore-hole motor substantially as described with reference to, and as shown in, the accompanying drawings.

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